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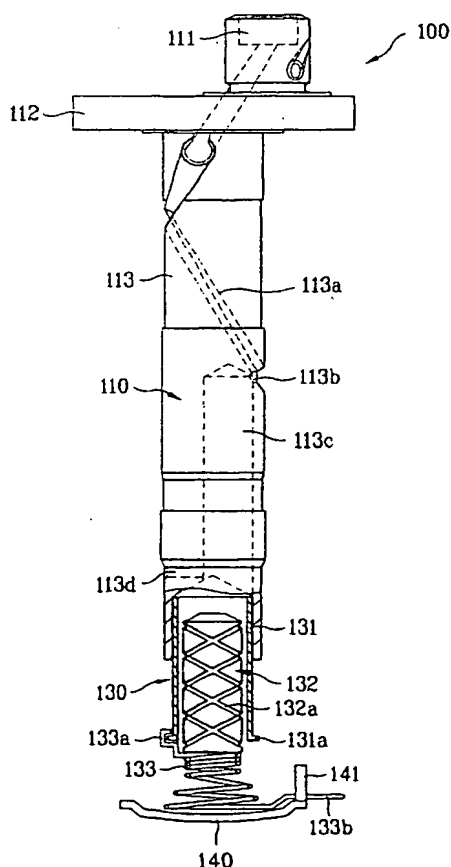
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(54) Title: OIL SUPPLY DEVICE FOR COMPRESSOR IN REFRIGERATING SYSTEM



(57) Abstract: Oil supply device (130) for a compressor in a refrigerating system including a cylindrical piece (131) fixed to a lower end of a crankshaft (110) for rotating together with the crankshaft, a propeller (132) fitted inside of the piece for making oil to rise by a relative movement with the piece (131), and rotation prevention means (141) fitted to a bottom end of the propeller (132) for prevention of rotation of the propeller, thereby supplying an adequate amount of refrigerant oil even if the compressor, operative at a low, as well as a high speed, is operated at the low speed.

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**Published:**

— *with international search report*

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## OIL SUPPLY DEVICE FOR COMPRESSOR IN REFRIGERATING SYSTEM

### Technical Field

5           The present invention relates to a compressor in a refrigerating system, and more particularly, to an oil supply device for a compressor in a refrigerating system, which can supply an adequate amount of refrigerant oil even if the compressor, operative at a low, as well as a high speed, is operated at the low speed.

### Background Art

10           In general, the compressor in a refrigerating system compresses a working fluid passed through an evaporator in a refrigerator or an air conditioner, to supply refrigerant to a condenser. A system of a related art reciprocating type compressor will be explained with reference to FIGS. 1-3B. FIG. 1 illustrates an overall system of a related art reciprocating type compressor in a refrigerating system, schematically.

15           Referring to FIG. 1, the related art reciprocating type compressor is placed in a space enclosed by a lower shell 2 and an upper shell 1. The compressor is provided with a motor part for generating a rotating force as the motor part has a current applied thereto, a compression part for compressing the working fluid by the rotating force from the motor part, and an oil supply part for supplying refrigerant oil to reduce  
20           friction in a mechanical part and cool down a heat from the mechanical part. The motor part is provided with a stator 21 for receiving a current to generate an electromagnetic force, and a rotor 22 for generating a rotating force from the electromagnetic force of the stator. The compression part is provided with a connecting rod 31 for converting a rotating movement into a linear reciprocating  
25           movement, and a piston 32 in a cylinder block for compressing the working fluid by the connecting rod. The oil supply part is provided with a crankshaft 110 and an oil supply device 120, wherein the connecting rod 31 has one end pin coupled to an eccentric part 111 on a top of the crankshaft, and the other end pin coupled to the piston 32. Accordingly, the connecting rod 31 converts the rotating movement of the

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crankshaft to a linear movement of the piston.

There is an oil plate (not shown) at a lower part of the lower shell filled with refrigerant oil, with a lower end of the oil supply device 120 submerged in the refrigerant oil. There is a hermetic terminal 11 and a cluster 12 at one side of the lower shell 2 for connecting the stator 21 to an external power. The cluster 12 has a plurality of lead wires 13 branched from the stator 21 fixed by terminals (not shown), which are connected with a plurality of pins passed through the hermetic terminal 11.

The oil supply part will be explained with reference to FIGS. 2-3B. FIG. 2 illustrates a front view of the oil supply part for the compressor in a refrigerating system, FIG. 3A illustrates a section of a piece press fit in a lower end of the crankshaft in FIG. 2, and FIG. 3B illustrates a front view of the oil supply device in FIG. 2, a propeller inserted in the piece.

The oil supply part 100 is provided with a crankshaft 110 and an oil supply part 120. The crankshaft 110 has an eccentric part 111 fitted eccentric from a shaft center, a weight balance 112 under the eccentric part 111 for prevention of vibration during rotation, and a shaft part 113 having a refrigerant oil rising passage under the weight balance 112. There is an oil hole 113b in the middle of length of the shaft part 113 in communication with an outside of the shaft part 113, and a helical oil groove 113a along an outer circumference of the shaft part 113 extended from the oil hole 113b to the eccentric part 111 on top of the crankshaft. There is a drill hole 113c in communication with the oil hole 113b, formed lengthwise eccentric from an axis of the shaft part 113.

According to this, when the crankshaft is rotated, the refrigerant oil introduced into the drill hole 113c by a centrifugal force of the oil supply device 120 flows to the oil groove 113a through the oil hole 113b, and sprayed onto a mechanical part as the refrigerant oil reaches to the eccentric part 111 through the oil groove 113a. The refrigerant oil sprayed thus lubricates the compressor, and absorbs a heat generated during operation of the compressor, for preventing the compressor suffer from damage caused by a high temperature and friction.

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There is a gas hole 113d in one side of the drill hole 113c opened in a point of a circumference of the shaft part 113 having a greatest distance to the drill hole 113c for discharging gas formed during the refrigerant oil is moved upward as the oil supply part is rotated to outside of the crankshaft 110.

5           In the meantime, the oil supply device 120 for pumping the refrigerant oil by using the centrifugal force has a cylindrical piece 131 inserted in a lower end of the shaft part 113 of the crankshaft 110, and a propeller 122 inserted in the piece for forming a rising passage of the refrigerant oil.

          The foregoing oil supply device 120 in the lower end of the rotating crankshaft  
10   110 rotates together with the crankshaft, when the refrigerant oil is pumped to the drill hole 113c as the refrigerant oil flows upward through the propeller in the oil supply device 120 by the centrifugal force, and, therefrom, to the oil groove 113a through the oil hole 113b. Then, the refrigerating oil lubricates a journal bearing (not shown) as the refrigerant oil flows upward along the oil groove 113a, and, at the end, moves up to  
15   the eccentric part 111 and is sprayed onto the mechanical part in the shell 1 and 2. The refrigerant oil sprayed thus is recovered by the oil plate at a lower part.

          In the meantime, in order to reduce a power consumption of a refrigerating system, currently a pole changing, or BLDC motor, operative at a low speed as well as at a high speed, is widely used as a compressor motor. However, the oil supply device  
20   provided for a high speed operation (approx. 3600rpm) can not supply the refrigerant oil smoothly during a low speed operation (approx. 1800rpm). That is, as the centrifugal force that is generated by the rotation of the oil supply device to move the refrigerant oil upward drops sharply when the compressor is operated at the low speed, the oil supply part can not supply the refrigerant oil, properly. Eventually, the  
25   compressor is involved in an excessive wear of the mechanical part, with a substantial reduction of lifetime of the compressor and an increased noise, as the compressor has a reduced performance of a heat dissipation, and reduced supply of the refrigerant oil.

#### Disclosure of Invention

Accordingly, the present invention is directed to an oil supply device for a

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compressor in a refrigerating system that substantially obviates one or more of the problems due to limitations and disadvantages of the related art.

An object of the present invention is to provide an oil supply device for a compressor in a refrigerating system, which can supply refrigerant oil smoothly during  
5 a low speed operation of the compressor.

Additional features and advantages of the invention will be set forth in the description which follows, and in part will be apparent from the description, or may be learned by practice of the invention. The objectives and other advantages of the invention will be realized and attained by the structure particularly pointed out in the  
10 written description and claims hereof as well as the appended drawings.

To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described, the oil supply device for a compressor in a refrigerating system includes a cylindrical piece fixed to a lower end of a crankshaft for rotating together with the crankshaft, a propeller fitted inside of the  
15 piece for making oil to rise by a relative movement with the piece, and rotation prevention means fitted to a bottom end of the propeller for prevention of rotation of the propeller.

The rotation prevention means includes an elastic member having one end fixed to a bottom end of the propeller, and a rotation prevention part for prevention of  
20 rotation of the elastic member.

The rotation prevention means includes a holding bar having one end held at a bottom end of the propeller, and a rotation preventer for holding the holding bar for prevention of rotation of the holding bar.

The elastic member is a conical coil spring having a lower part diameter  
25 greater than an upper part diameter.

It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

### Brief Description of the Drawings

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description  
5 serve to explain the principles of the invention:

In the drawings:

FIG. 1 illustrates an overall system of a related art reciprocating type compressor in a refrigerating system, schematically;

FIG. 2 illustrates a front view of the oil supply part for the compressor in a  
10 refrigerating system in FIG. 2;

FIG. 3A illustrates a section of a piece press fit in a lower end of the crankshaft in FIG. 2;

FIG. 3B illustrates a front view of the oil supply device in FIG. 2, a propeller inserted in the piece;

15 FIG. 4 illustrates a section of an oil supply part for a compressor in a refrigerating system in accordance with a preferred embodiment of the present invention;

FIG. 5 illustrates a front view of an oil supply device in accordance with a second preferred embodiment of the present invention;

20 FIG. 6 illustrates a front view of an oil supply device in accordance with a third preferred embodiment of the present invention; and,

FIG. 7 illustrates a side view of the rotation prevention part in FIG. 6.

### Best Mode for Carrying Out the Invention

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings  
25 FIGS. 4-7. FIG. 4 illustrates a section of an oil supply part for a compressor in a refrigerating system in accordance with a preferred embodiment of the present invention.

Referring to FIG. 4, the oil supply part 100 in a refrigerating system includes a

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crankshaft 110 and an oil supply device 130, wherein the crankshaft 110 has an eccentric part 111, a weight balance 112, and a shaft part 113. The crankshaft is press fit in a center part of the rotor 22 to rotate as the rotor rotates. The oil supply device 130 is disposed at a lower end of the crankshaft, and includes a piece 131, a propeller 132, and rotation prevention means. The piece 131 is hollow and cylindrical with opened ends, and press fit in a lower end of the shaft part 113. The propeller 132 is fitted in the piece 131 such that an inside circumference of the propeller 132 and an outside circumference of the piece 131 form a clearance. The propeller 132 fitted thus has a plurality of helical grooves 132a in the outer circumference from a bottom end to a top end thereof, and it is preferable that two or three of the helical grooves 132a are formed in the propeller 132 for an optimal flow of the refrigerant oil. Of course, instead of the helical grooves in the outside circumference of the propeller, the helical groove may be formed in an inside circumference of the piece.

In the meantime, the rotation prevention means is fixed at a bottom end of the propeller 132, including an elastic member 133 having one end fixed to the bottom end of the propeller, and a rotation prevention part 141 for prevention of rotation of the elastic member. In this instance, a holding part may be formed at a bottom end of the propeller 132 for inserting, and fixing the top end of the elastic member 133. The rotation prevention part is projected from a dish 140 under the elastic member for receiving dirt.

Thus, since the propeller 132 is fixed by the elastic member at the bottom end thereof to be set with a fixed gap to the piece 131, the propeller 132 does not rotate even if the piece 131 rotates. The propeller and the piece can be damaged as a rotating axis of the piece 131 is shaken by an external force or vibration during the piece 131 rotates, for preventing which it is preferable that the elastic member 133 is one having an outward elasticity with respect to the rotating axis of the piece 131, such as a coil spring. Moreover, it is more preferable that the elastic member is a conical coil spring having an upper part diameter smaller than a lower part diameter, for a wide range absorption of vibration occurred in a rotation axis direction of the propeller 132



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by the refrigerant oil flowing upward through the helical groove 132a during rotation of the piece 131. The foregoing elastic means 133 is fixed to the bottom end of the propeller 132 such that an helical direction of the elastic member 133 is the same with the rotation direction of the piece 131 when the elastic member is seen from the bottom  
5 end of the elastic member, for preventing the propeller 132 from falling off the elastic member 133 as the elastic member is fastened during the piece 131 is rotated. Furthermore, it is preferable that the elastic member 133 fixed to the propeller 132 has a wire diameter smaller than the compressor support springs 3 shown in FIG. 1, for supporting the mechanical part of the compressor from below and attenuates vibration  
10 occurred at the compressor, to minimize an influence of the vibration to the elastic member 133 fixed to the propeller 132 even if an excessive vibration of the compressor affects to the elastic member 133 fixed to the propeller 132.

In the meantime, there is an annular rim 131a projected outward from a bottom end of an outside circumference of the piece 131 for preventing buckling of the bottom  
15 end of the piece 131 when the piece 131 is pressed into the shaft part 113. There is a holder 133a at one end of the elastic member 133 in correspondence to the rim 131a to engage the holder 133a with the rim 131a, to fix the elastic member 133, for more stable fastening of the propeller 132 fixed to the top end of the elastic member 133. Because it is required that the holder 133a does not rotate even if the rim 131a rotates,  
20 the holder is required to have a certain clearance to the rim when the holder is engaged with the rim. Consequently, it is preferable that the holder has a "C" form for preventing the holder from falling off the rim 131a.

Since a lower part of the oil supply device is submerged in refrigerant oil, even if the rim 131a comes into contact with the holder 133a during the rim 131a rotates,  
25 there is no noise generated. Though the bottom end of the elastic member 133 may be fixed to the dirt dish 140, one embodiment in which the elastic member is fixed to the dirt dish 140 will be explained. The elastic member has an outward extension 133b at a bottom end, and the dirt dish 140 has a rotation preventer 141 for holding the extension 133b. The extension 133b has a "—" form extended outward in a direction

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of helix of the coil spring. The rotation preventer 141 projected upward may merely hold the extension 133b or presses the extension 133b to stop the extension 133b.

In the foregoing oil supply device 130, as the propeller 132 is kept stationary when the piece 131 is rotated, the propeller makes a relative movement as the piece 131 is rotated. Then, the refrigerant oil flows upward through the helical groove 132a by a centrifugal force caused by the relative movement of the piece 131 and the propeller 132, and a viscosity of the refrigerant oil. Then, the refrigerant oil introduced into the drill hole 113c through the helical groove 132a reaches to the oil hole 113b, and, in continuation, is sprayed onto the mechanical part after the refrigerant oil is moved to the eccentric part 111 while the refrigerant oil lubricates the journal bearing outside of the shaft part 113. According to this, an adequate amount of refrigerant oil can be pumped through the helical groove 132a even in a low speed operation of the compressor.

FIG. 5 illustrates a front view of an oil supply device in accordance with a second preferred embodiment of the present invention. Since a piece and a propeller of the second embodiment have the same structure and operation with the first embodiment, no more explanation of the same will be given.

An elastic member having a top end fixed to a bottom end of the propeller has an extension 133b extended from the bottom end of the elastic member, and the extension 133b has a first extension 134a extended outward from the bottom end, and a second extension 134b bent backward and extended to an under side of the first extension 134a in an arc from an external end of the first extension 134a. According to this, the second extension 134b is held by the rotation preventer 141 projected upward from the dirt dish, to prevent rotation of the elastic member 133 while the piece 131 rotates. The first and second extensions 134a and 134b absorb a wider range of vibration transmitted from the propeller 132 during the piece 131 is rotated.

FIG. 6 illustrates a front view of an oil supply device in accordance with a third preferred embodiment of the present invention, and FIG. 7 illustrates a side view of a grip of the rotation prevention part in FIG. 6. In the oil supply device of the third

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embodiment, since a propeller 132 have the same structure and operation with the first embodiment, no more explanation of the same will be given.

Referring to FIGS. 6 and 7, different from the first, or second embodiment, a piece of the third embodiment, press fit and fixed to a bottom end of a crankshaft, is cylindrical, without the rim at a bottom end of an outer circumference of the piece. There is a holding bar 135 inserted in the bottom end of the propeller 132, with one end bent at a right angle to a length of the holding bar 135. There is a rotation preventer 141 projected from the dirt dish 140. As shown in FIG. 7, the rotation preventer 141 has a grip 141a of "C" form opened downward at one end thereof in a side view. As the other end of the holding bar 135 is inserted and held at the grip 141a of the rotation preventer 141, the propeller 132 held at the holding bar 135 is made stationary. After the propeller is made stationary, the compressor is set while the piece 131 is inserted around the propeller 132. When the compressor is set, a bent part 135a of the holding bar 135 comes to press a bottom end of the piece 131. Then, as the piece 131 is rotated, the piece presses the holding bar such that the other end of the holding bar 135 comes out of the grip 141a. Even if the holding bar 135 comes out of the grip 141a, rotation of the propeller 132 can be prevented by the rotation prevention part 141 formed on the dirt dish. As there is refrigerant oil rising between the propeller 132 and the piece 131 while generating a centrifugal force when the piece 131 is rotated, a gap is maintained between the propeller 132 and the piece 131, thereby preventing friction between the two. Accordingly, an adequate amount of refrigerant oil can be supplied even if the compressor is operated at a lower speed by the centrifugal force generated by the relative rotation between the propeller 132 and the piece 131, and the viscosity of the refrigerant oil, permitting to prevent wear of the compressor and damage caused by temperature rise of the mechanical part during a lower speed operation of the compressor.

#### Industrial Applicability

As has been explained, in a reciprocating type compressor which is operative both at a high speed and a low speed, the oil supply device for a compressor in a

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refrigerating system of the present invention can supply an adequate amount of refrigerant oil to the eccentric part on top of the shaft part, thereby improving a reliability of the compressor as wear down of various components of the compressor can be prevented and a heat generated from the mechanical part can be dissipated.

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## CLAIMS

1. An oil supply device for a compressor in a refrigerating system comprising:  
a cylindrical piece fixed to a lower end of a crankshaft for rotating together with the crankshaft;  
5 a propeller fitted inside of the piece for making oil to rise by a relative movement with the piece; and,  
rotation prevention means fitted to a bottom end of the propeller for prevention of rotation of the propeller.
- 10 2. An oil supply device as claimed in claim 1, wherein the rotation prevention means includes;  
an elastic member having one end fixed to a bottom end of the propeller, and  
a rotation prevention part for prevention of rotation of the elastic member.
- 15 3. An oil supply device as claimed in claim 2, wherein the rotation prevention part is projected from a dirt dish provided under the elastic member.
4. An oil supply device as claimed in claim 1, wherein the piece has helical grooves in an inside circumference, or the propeller has helical grooves in an outside  
20 circumference of the propeller.
5. An oil supply device as claimed in claim 4, wherein the helical grooves are plural.
- 25 6. An oil supply device as claimed in claim 7, wherein the helical grooves are two or three.
7. An oil supply device as claimed in claim 2, wherein the elastic member is a coil spring.

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8. An oil supply device as claimed in claim 7, wherein the coil spring is conical with a lower part diameter greater than an upper part diameter.

5           9. An oil supply device as claimed in claim 7, wherein the coil spring is fitted such that the coil spring has a helix direction the same with a direction of rotation of the piece when the coil spring is seen from the bottom end side thereof for fastening the spring when the piece is rotated, for preventing the propeller held at the spring from falling off the piece.

10

10. An oil supply device as claimed in claim 7, wherein the coil spring has a diameter smaller than compressor support springs fitted at a lower part of the compressor, for absorbing vibration occurred as the compressor is rotated.

15

11. An oil supply device as claimed in any one claim in claims 7 - 10, wherein the coil spring has an extension from a bottom end for prevention of rotation of the coil spring as the extension is held by the rotation prevention part.

20           12. An oil supply device as claimed in claim 11, wherein the extension has “-  
“ form.

13. An oil supply device as claimed in claim 11, wherein the extension includes;

25           a first extension outward from the bottom end, and  
a second extension bent backward extended to an under side of the first extension from an external end of the first extension to form a “C” form.

14. An oil supply device as claimed in claim 1, wherein the piece includes;  
an annular rim projected outward from an outer circumference of a bottom end

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of the piece for prevention of buckling of the piece when the piece is press fit into a lower end of the crankshaft.

15. An oil supply device as claimed in any one claim in claims 7-10, wherein  
5 the elastic member includes a holder at one end for engagement with the rim on the piece, for preventing the propeller from falling off the piece when the piece rotates.

16. An oil supply device as claimed in claim 15, wherein the holder has a “C”  
form in correspondence to the rim.

10

17. An oil supply device as claimed in claim 1, wherein the rotation prevention  
means includes;

a holding bar having one end held at a bottom end of the propeller, and  
a rotation preventer for holding the holding bar for prevention of rotation of the  
15 holding bar.

18. An oil supply device as claimed in claim 17, wherein the rotation preventer  
is projected from a dirt dish provided under the elastic member.

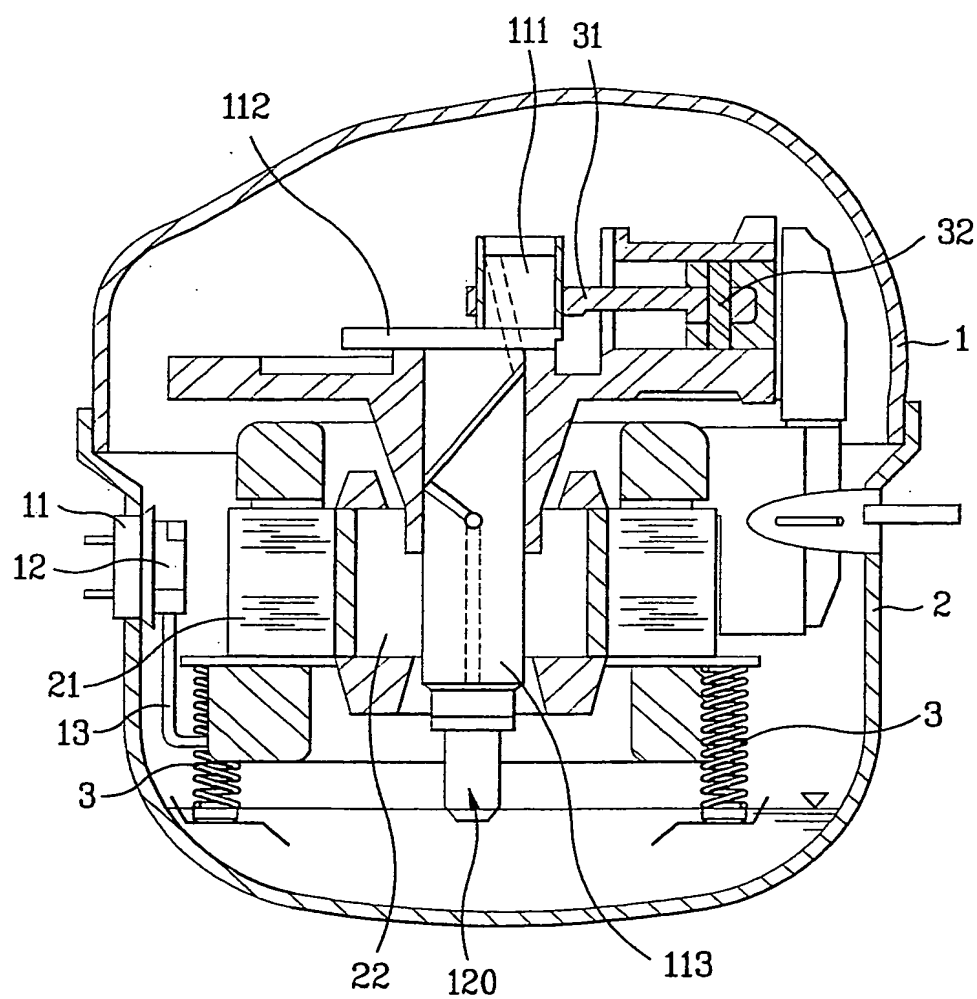
20 19. An oil supply device as claimed in claim 15, wherein the rotation preventer  
includes;

a grip of a “C” form opened downward at one end thereof in a side view, for  
preventing the propeller from falling off the piece when the holding bar is inserted in  
the grip, and a mechanical part of the compressor is set.

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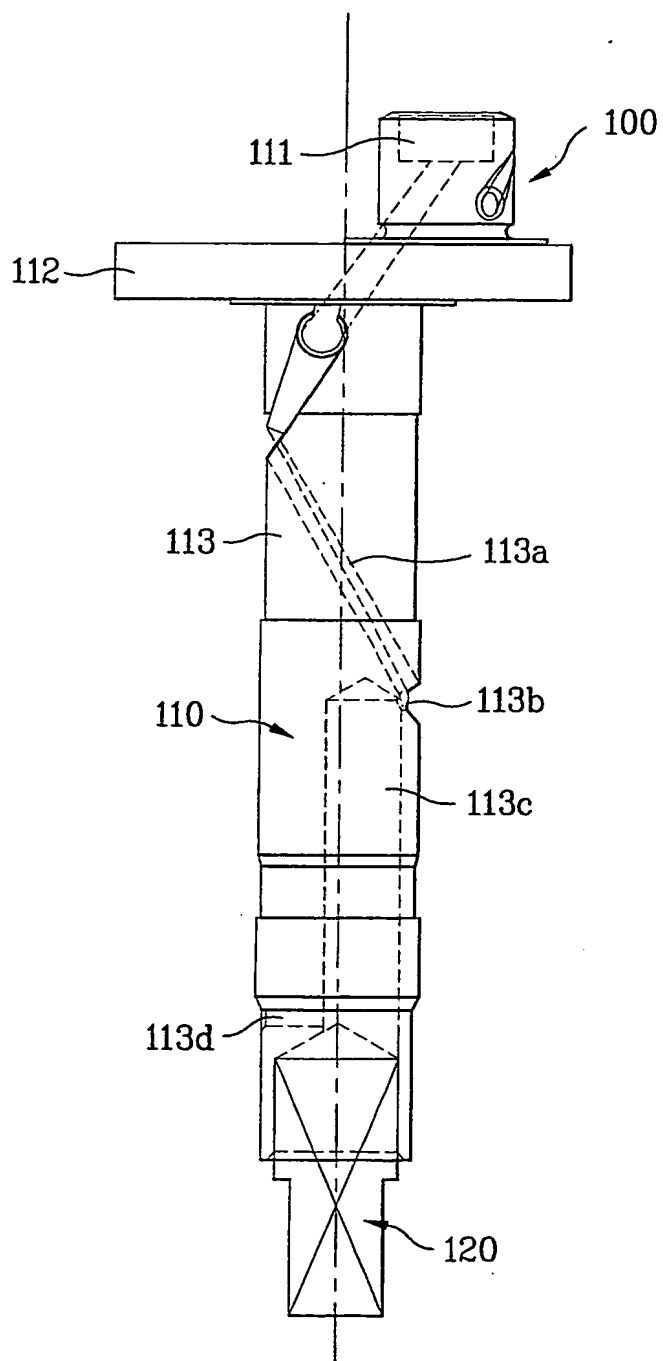
FIG. 1  
Related Art





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FIG. 2  
Related Art



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FIG. 3A  
Related Art

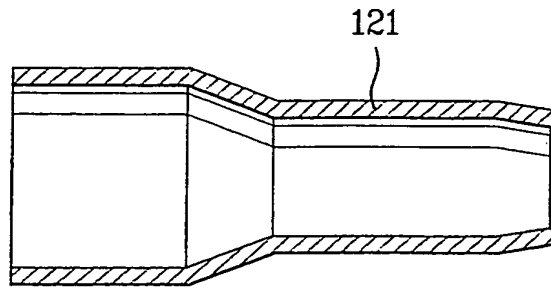
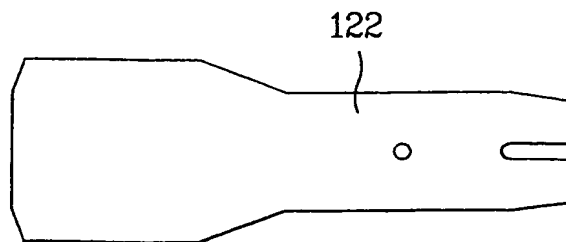
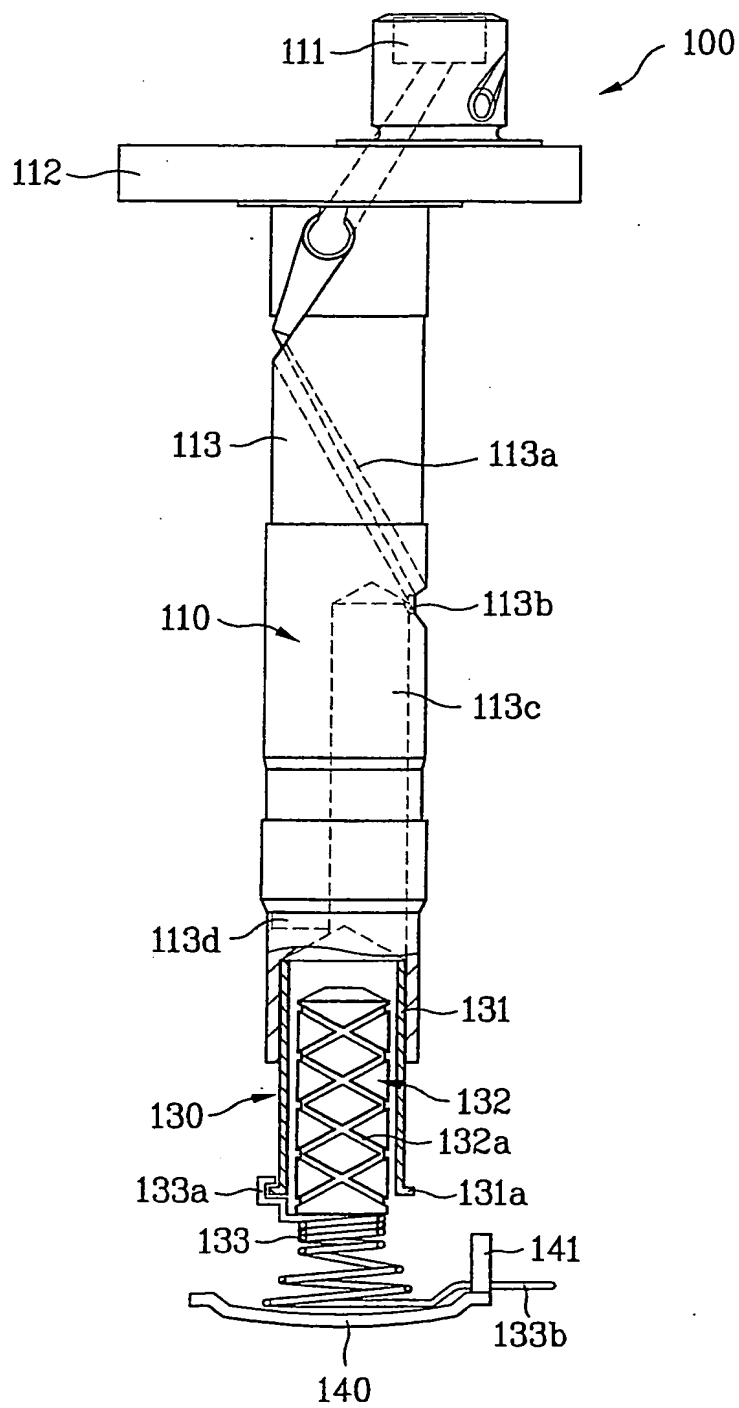


FIG. 3B  
Related Art



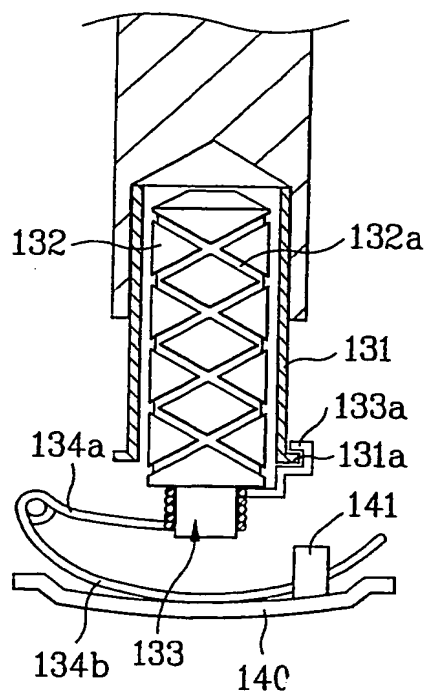
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FIG. 4



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FIG. 5



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FIG. 6

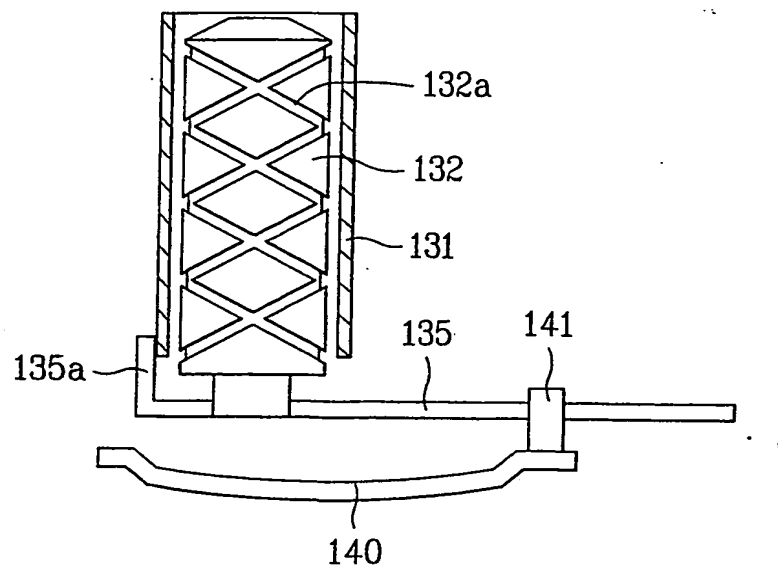
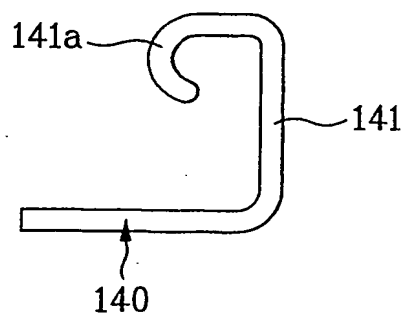


FIG. 7



## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/KR 01/01288

## CLASSIFICATION OF SUBJECT MATTER

IPC<sup>7</sup>: F04B 39/02

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC<sup>7</sup>: F04B; F16N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	WO 00/01949 A1 (ZANUSSI) 13 January 2000 (13.01.00) <i>the whole document.</i>	1,2,4 3,5-19
X A	GB 768058 A (TEVES) 13 February 1957 (13.02.57) <i>the whole document.</i>	1,4 2,3,5-19
X A	JP 60-119389 A (TOSHIBA) 26 June 1985 (26.06.85) <i>the whole document, esp. figs. 2,3,6.</i>	1,4 2,3,5-19
A	WO 93/22557 A1 (EMPRESA BRASILEIRA DE COMPRESSORES) 11 November 1993 (11.11.93) <i>the whole document.</i>	1-19

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Date of the actual completion of the international search

2 April 2002 (02.04.2002)

Date of mailing of the international search report

18 April 2002 (18.04.2002)

Name and mailing address of the ISA/AT

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Kohlmarkt 8-10; A-1014 Vienna

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Form PCT/ISA/210 (second sheet) (July 1998)

## INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

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JP	A2	60119389	26-06-1985	none			
WO	A	1949		none			
WO	A1	9322557	11-11-1993	BR	A	9201761	09-11-1993
				CN	B	1034603	16-04-1997